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ABSTRACT

This study was conducted during 2 school years, involving one teacher and one classroom from each of four elementary (grades 1-2) and secondary schools. The study included writing activities on the word processor, videoconferencing, and World Wide Web use. The main data source was a series of videotapes of the above mentioned activities. Researchers interviewed students informally, and teachers participated in informal talks and submitted written commentaries. At the time of publication, data analysis was still in progress. Provisionary findings include: (1) videoconferencing promotes the connection between people at various levels and in several ways; (2) information provided on the Web, following a hypermedia structure, but with a dominant amount of text, provides opportunities for the development of written comprehension; (3) interdisciplinary writing activities are a good way to improve writing skills and provide students with an opportunity to use writing not only as an object of study, but also as a learning tool; (4) cooperative learning environments encourage students to share and discuss ideas, as well as encourage the less skilled ones to participate; and (5) there are no easy or definitive answers to integrating technology into educational learning contexts. Further data analysis will be conducted. (Contains 61 references.) (DLS)

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Using Technologies And Cooperative Work To Improve Oral, Writing And Thinking Skills: Voices From Experience

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Introduction

Whether we like it or not, the nature of literacy and learning is being redefined by the digital technologies that are quickly becoming a part of the information age in which we live.
(Donald Leu Jr., 1996)

In spite of some disagreeing voices (Oppenheimer, 1997; Postman, 1993) the advances that technology offers to actual society and education are irrefutable (Freitas, 1997; Leu, 1996; Mehlinger, 1995; Negroponte, 1995).

In such a society, where technological, political and social progress narrows more and more the boundaries among people, schools and countries, "information access, problem solving, and communication are essential to success in the information age in which we live". (Leu, 1997, p. 63). Schools play an essential role in preparing students to work and live in this world (Freitas, 1997; Magildson, 1997). Therefore, teachers need to be skilled in the use and application of these technologies in rich communicative contexts: "[T]he role of the teacher will be essential in fostering an environment that creates teaching and learning opportunities and uses the technology to its best advantage" (McHenry, 1997, p.24).

The University of Minho, in Portugal, where we teach, has a great tradition in encouraging and supporting educational technology activities in schools in a collaborative, informal and practice-centered way because we believe, that "there are few topics more important than the role of technology in education" (Hong, 1997, p.188) and we believe also that investigators and teachers can help each other. In fact, as it was previously said by one of us "The full sense of practice just happens whether it has its foundations grounded in theory or it provides a basis for theory building " (Freitas, 1997, p.15). In addition, to the extent these technologies proliferate schools, researchers are under pressure to develop knowledge useful both for teacher training courses, in University, and for practitioners as a way to avoid that "what had started as a subversive instrument of change was neutralized by the system and converted into an instrument of consolidation" (Papert, 1994, p.39).

The fact is that there is a growing body of research focusing on educational technology. However, combining technologies, like Web, videoconference and word processor, with cooperative work to improve language skills, was not done before, at least in Portugal. On the other hand, the present study differs from some previous ones in several ways: a) activities were carried out in authentic classroom context, rather than in laboratory; b) texts written using the word processor were based on real purposes rather than on specially ones written for research; c) data collected include researchers' observations, teachers' commentaries and students' voices, until now often ignored. The analysis was based on grounded theory methodology, one of the most fruitful and used ways of carrying out qualitative research when researchers' main objective is generating theory.

So, in this study, we "does not begin with a theory, then prove it. Rather, one begins with an area of study and what is relevant to that area is allowed to emerge" (Strauss & Corbin, 1990, p. 22).

Theoretical guidelines

Our approach (Freitas, 1997), which is not just ours (see, for instance, Wilson, 1996) is that educational technologies must be used in contexts promoting interaction and allowing access to various information resources and supports. Through wide discussion with peers this information is clarified, allowing a greater understanding of the subjects under study. This approach is consistent with cooperative learning and constructivist approach assumptions.

Among the various approaches to constructivism (Brooks, 1997; Brunning, 1995; Coll, 1996; Carretero, 1997) we adopted the Duffy and Cunningham one as it was referred by Ritchie. They "identified two common

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characteristics of constructivism environments: a) students learn by actively constructing rather than acquiring knowledge; and, b) the purpose of instruction is to support this construction, rather than the communication of information" (1997, p.27).

By and large, extensive research provided evidence that cooperative learning improves academic achievement, facilitates both cross-ethnic and cross-sex inter-group relationships, and increase self-esteem (Johnson & Johnson, 1981; Johnson, Johnson & Maruyama, 1983; Slavin, 1985; Slavin & Karwait, 1981). A recent study developed by Brush to investigate whether cooperative learning techniques helped to improve success with students in Integrated Learning Systems (ILS) concluded that integrating cooperative learning with ILS-delivered instruction is an effective instructional strategy. Results showed that students working on math activities delivered by an ILS performed better on achievement tests of the content taught when they completed the activities in cooperative pairs than when they worked in activities individually (1997, p. 61).

Other studies in this domain suggest that working together and supporting each other "stimulates initiative, attention to details of performance, and commitment in activity Ô more expert play partner can facilitate the social pretense in low-play peers and not at their own expenses" (Newman, 1997, p.17). Xypas (1997), as others did before (e.g., Smith, Johnson, & Johnson, 1981, 1984), stresses the educational value of conflict that often occurs when students work together. He argues that this conflict impels students to construct more deeply rooted arguments and explanations and gives them the opportunity to assist one another. This peer discussion contributes to cognitive and social gains. Besides, such a supportive learning environment helps to reduce the negative statute of mistakes, that often are a source of anxiety and stress, encouraging students to approach them as the "rolling-carpet" of their cognitive and social growing (Astolfi, 1997).

Creating learning situations that aim at improving linguistic skills and are cognitive and emotionally stimulating for students is, probably, the greatest challenge of language learning teachers. Current language learning perspectives, such as communicative and whole language approaches, suggest the creation of authentic communicative situations in which students a) use language realistically, as a real means of communication in real situations; b) learn and practice language skills - listening, speaking, readifng and writing in a meaningful and integrated way.

As asserted by Landsmann (1995) language learning activities must occur in contexts that promote active learning since students need opportunities to compare and share ideas as a means to reflect about their oral and writing productions and improve them.

The practice of writing skills is also a privileged way to increase thinking skills (Schneuwly, 1988) to the extent that writing makes it possible to reach the most abstract level of language (Vygotsky, 1979, 1993).

Recent approaches to writing suggest that it is a complex and dynamic process consisting of a set of phases (d'Aoust, 1989; Hayes & Flower, 1980). These phases may be focused or not, conscious or unconscious and they are nor independent neither sequential, rather they interact in a recursive process. They include several sub-processes, organized and labeled in several ways by different authors. Summing up, in the writing process we have writing, sharing, revision, correction and evaluation.

Pre-writing activities are supposed to stimulate and shape ideas; writing is the phase in which ideas are materialized in the written word. Sharing allows the writer to revise and improve his text having in mind the feedback given by peers and teacher. In the revision and correction phases, students make further improvements: words, sentences, paragraphs or the whole text. This is the very moment in which the teacher can explore and conduct educational work in relation to language structure and functions. The evaluation, the final feedback, assuming usually the form of assessment, is the final phase of writing

The only ways to increase writing skills are practicing, learning by doing, as suggested by constructivist approaches. Writing tasks for several purposes and in various curricular domains gives students these opportunities to practice writing.

Besides, writing together also gives students an opportunity to improve writing. By constant and constructive feedback provided by peers, by reflecting about their own and other's writing, they can increase writing skills. New writing tools, like word processor, supported by teachers when necessary, increases the group work potential, since they facilitate corrections and improvements in written texts. In addition such a supportive environment develops students self-confidence in expressing themselves, orally and in writing. This is an important first step in improving students' communicative skills.

Therefore, technologies and cooperative learning may contribute to implement learning environments based on constructivist principles that emphasize the central role of communication in language learning.

The Portuguese Curriculum framework

The last curriculum reform (1989) prescribes the adoption of group work to promote and improve cognitive, social and affective skills. Curriculum guidelines also suggest that: a) students must have access to new technologies in various ways namely for the searching, interpreting, organizing and evaluating information; b) technologies must be envisioned as a tool to increase learners development of social and cognitive skills related to several curricular domains. Portuguese syllabi consider that reading and writing instruction must be carried out in several learning environments that stimulate interaction and cooperation between students encouraging successive improvements in written texts as a way to develop writing and thinking skills. Curriculum guidelines also advise that teachers must find learning contexts promoting an integrated development of listen, speaking, reading and writing skills. They also enhance the teacher responsibility in creating active and learner centered activities where processes, rather products, were valued.

These general guidelines follow, generally speaking, theoretical assumptions we have already presented.

Research design

This study was designed and conducted following the qualitative paradigm, which fits well the nature of this study. Following Strauss and Corbin "qualitative methods can be used to uncover and understand what lies behind any phenomenon about which little is yet know ... and can give the intricate details of phenomena that are difficult to convey with quantitative methods" (p.19).

We combined several approaches, following a trend of utilizing mixed-methods (Creswell, 1994; Greene, Caracelli, & Graham, 1989; Guba, 1992). Although we may consider our research as ethnographic, the *grounded theory* (Glaser & Strauss, 1967; Strauss, 1995; Strauss & Corbin, 1990) was the main approach in this study.

Intervention Design

We have selected teachers who usually create learning environment that follow the orientations of theoretical framework of this study, and routinely use educational technology in their classrooms for several purposes.

The research team was directly involved with school teachers. Nevertheless, we both consider that teachers have a central role and the main responsibility in designing learning environments where educational technologies are integrated. So, our role as researchers is not to orient as experts, but to facilitate and support teachers work in this domain.

The study was conducted during two school years in four elementary (grades one and two) and secondary schools, involving just a classroom and a teacher each one. It included mainly writing activities with the word processor but also videoconference and WWW for pre-writing activities and other purposes.

Videoconference

Five videoconferences were carried out: two for research team and school teachers to plan the students' activities, testing the connections and other details; three integrated in pre-writing students' activities. All the videoconferences were implemented between University of Minho, Portugal, and the University of Exeter, U.K. where a colleague of us, who was taking his PhD there, helped to set up the sessions.

Secondary students came from a professional course in media communication, so their aim was to know, in a hands-on way, how videoconference system works and its role in actual media communication field. From Exeter, our colleague demonstrated the functioning of videoconference system and other multimedia tools and services. They also discussed implications of videoconference in social, personal and educative domains.

Videoconference sessions for elementary students followed a different approach. Students developed project work in class comparing some aspects of society and culture in both countries to exchange ideas about that. As their colleagues did, they had previously prepared a set of topics, questions and other materials, like pictures, cards and written slogans, to support the presentation of their project work. Colleagues who did not participate in videoconference engaged in other kind of activities integrated in their global project work.

WWW

As in videoconference, the intention of secondary students was to know how Web works rather than using it as a way of gathering specific information. The aim of preparatory students was to obtain information related to their specific subject of project work they usually do. The class was split in groups. Each group participated in three 3 hour sessions.

In the first session, and after an initial period of free web browsing, students conducted web searches according to their interests. They had previously chosen a number of topics and key words in English, which were used to search for information. They were allowed to choose navigation itineraries. In order to prepare the second session, a number of selected web sites were bookmarked. The information retrieved was printed out and studied during the week as homework and in class. With teacher support, topics for further exploration in the second session were selected.

In the second session the collection of information was completed. A vast amount of topics followed by an abstract, in English, resulted from this process. Students then analyzed this information: they identified the issues emerging and selected topics, which were translated into Portuguese. After that, they discussed and structured their ideas and outlined a plan of a text to be written later. The role of the teacher was fundamental in this phase, in order to help students to select, organize and structure the available information. Finally, students wrote texts in a collaborative way and using word processor.

The third session occurred the next school year and was similar to the first ones, as only the project subjects changed.

Word processor

In students writing we considered pre-writing, writing and revision-correction phases. Although videoconference and web activities had other aims, they were also considered as pre-writing activities. They intentionally included different curricular subjects as a way to promote an interdisciplinary approach. As referred by Kaufman (1994) it is absurd that teachers promote writing tasks only as a means to evaluate students' ability to write. Promoting writing activities in several curricular domains was a natural way to practice and improve writing skills.

Written activities with word processor were carried out at schools in various contexts, including language classes. Students were randomly organized in groups. They wrote as they usually did. No suggestions about writing process were given to students. Texts produced had a real audience because they were integrated in several communicative circuits, like school newspapers, project work and exhibitions.

Data collection

Data were collected by different methods and from different sources: classroom observation, students' interviews and teacher description, evaluation and comments to the activities carried out.

Data triangulation increased the validity of the study (Cohen & Manion, 11989; Denzin, 1978; Foster, 1996; Marshall & Rossman, 1989; Maxwell, 1996; Scott, 1996) and help to grasp the complexity of the research area.

The main data source were a series of videotapes on videoconference, WWW and word processor activities above presented. There was a total of 40 hours of observation. All videotapes were transcribed.

We interviewed students informally. Students had to respond to both general and specific questions about activities they carried out with technologies. We also presented some open-ended questions designed to give students the opportunity to share their perceptions and approaches and to explore their thinking not only about task carried out but also about future work. All interviews were videotaped and transcribed.

Teachers were also asked to give their opinions about work carried out with technologies by means of informal talks at the end of each session and by written commentaries.

Data analysis

The process of data analysis is still in course and it began during data collection itself, where some general patterns began to emerge. In the next step, all observations and interviews were transcribed as completely and literally as possible with some essential prosodic features.

These transcripts are being analyzed using the grounded theory methods (Glaser & Strauss, 1967; Strauss, 1995; Strauss & Corbin, 1990). Theory will be inductively built using well-established steps. The first procedure of

open coding is breaking down and conceptualizing data. The patterns that emerged were then categorized and potential labels are being explored.

The next analytic procedure, *axial coding*, involves linking subcategories to a category by tracing relations between them in terms of *causal conditions*, *phenomena studied*, *context*, *intervening conditions*, *action/interaction strategies*, and *consequences*. This *paradigm model* shows interdependency of categories.

Selective coding procedures shall lead us to the conceptualization of the central phenomenon, the *core category*, around which all the other categories are integrated. This is the core message of the research.

These themes and emerging trends are presented as proposition statements.

As a matter of fact, many authors (Lee & Fieldind, referred by Prothero, 1996; Miles & Huberman, 1994;) suggest that qualitative researchers can not ignore computer software for qualitative data analysis. According to Richard and Richard (cited by Prothero, 1996) "the computer allows researchers to explore and interrogate emerging patterns, to keep asking questions and drawing together different levels, contexts, relationships to test their significance and to chase ideas about the ways they pattern data".

Our choice for qualitative data analysis software was Nud•ist (Non-numerical Unstructured Data Indexing, Searching and Theorizing). This is a multi-functional software system that helps researcher to handle non-numerical unstructured data by indexing searching and theorizing.

Up to the present moment, we have identified and broadly described the key features of some emergent patterns. In this first step of data analysis we seek to identify emergent "voices" still without their articulation and integration. According to the title of this paper, we just report here these "voices from experience" in a preliminary framework of research findings.

Research findings and discussion

Findings, although provisory, as we have clearly stated, allow us to enhance some of the key emergent voices and to realize that, often, they tune with voices from other research studies.

1. Videoconference promotes the connection between people at various levels and in several ways.

The *cyberspace* "that invisible arena where humans are connected by electronic technology, not by geographic proximity" (Anderson-Inman, 1996, p. 134) allows a climate very similar to face-to-face communication which creates a real need to express their ideas and to listen and understand colleagues in a really interactive way.

Students from different places and with different backgrounds and capabilities work together discussing personal ideas and sharing information about different curricular subjects in a vivacious and authentic interpersonal communication. This collaboration not only allows different perspectives in treating subjects, but also increases students' oral skills. Students must think and react rapidly and this spontaneity added to peer support stimulates some interventions of less skilled students that usually do not take this risk. In fact we noticed remarkable interventions and even "flash of eloquence" of special needs students who usually were silent in other classroom activities. It seems that colleagues support and communication atmosphere itself increased their self-confidence leading them to overcome a bit their affective and linguistic difficulties.

In such an authentic and dynamic situation, where students must find quickly and efficiently what they need, it was easily accepted both by teachers and by students that speech was not always correct. However, from time to time, they asked for help, reformulated speech and they were spontaneously corrected and supported by colleagues which reveals their interest in improving their language skills. Giving immediate, contextual and friendly feedback seems to be a good way to articulate theory and practice in language learning.

We noticed that, in spite of students' enthusiasm and happiness to "meet in virtual classrooms, collaborating and co-constructing their educational experience" (Anderson-Inman, 1996, p. 137), their best pleasure will be to meet personally their new British friends. It was clear that videoconference does not replace or diminish face-to-face relationships that are essential in education as in life; rather it creates in students the need to know better people they interacted with.

One of the major challenges in foreign language learning is to create environments where students are so immersed in target language contexts, that they really need to communicate with others. Such an authentic environment encourages the discovery of language as tool for real communication purposes. Evidence we have collected suggest that videoconference offers a great opportunity for it.

2. The way the information is provided on the Web, following a hypermedia structure but with a dominant amount of text provides opportunities for the development of written comprehension. We noticed that students read

attentively in order to make further choices. This hypertext/hypermedia model also required the development of new reading techniques: due to the amount of information they are faced with, students quickly discover reading must be selective and oriented to their interests. So, they are forced to abandon the sequential reading way they are used to and adopt pro-active, flexible and focused reading and selection strategies.

Web based activities provide an opportunity to improve linguistic skills both in Portuguese and in English because students constantly translate between these two languages either to input search queries or to understand search results.

Gathering information in Web also promotes the development of the thinking skills required by information search, selection, analysis, evaluation and synthesis - these abilities are becoming increasingly important nowadays. Students outlined, discussed and refined search strategies seeking for more precision. Given the quantity and variety of information collected, students gathered a wide variety of perspectives and ideas with a range of levels of complexity. According to Ryder & Graves the "Information age literacy requires learners who are proficient in focusing attention, attending to an accessible and dynamic medium, and thinking critically" (1997, p. 251). Then, in a synthesis process, students compared, contrasted and structured the information under a coherent framework: "Information literacy requires learners to obtain and derive meaning from diverse and extensive sources of information and to regulate their own thinking in pursuit of a level of understanding that goes well beyond memorizing the details of a classroom textbook" (Ryder & Graves, 1997, p 252). Carrying out these tasks requires skills classified by Bloom at the top of the hierarchy of cognitive objectives.

Evaluating validity of the information available in web, on one hand, and selecting the most important topics, on the other hand, are probably the biggest and more complex challenge both for teachers and for students. In fact, as stressed by Roberts "students need to evaluate the content of what they find on-line, just as they do with traditional sources. Evaluating sources and comparing facts and opinions are essential activities when exploring on-line databases". But, the same authors remark, "How can children learn to evaluate the information they obtain?" (1990, p.79).

Since students worked in groups, they had the opportunity to share ideas, achievements and difficulties, both in content domains, searching features and linguistic area. This kind of task in such a context provides support, encouragement, and, as asserted by Oliver (1997), the development of students' social and thinking skills.

According to Roberts "just as the world is exploding with new information, it is also becoming increasingly complex. Today, answering questions, solving problems, and exploring new ideas requires that people work together.... This collaboration requires communication, communication with people in next office, in another city, or around the world" (1990, p.3). Once again, this emphasis in collaboration and communication demonstrates how useful are Web based activities for the present and future life of students.

With Ryder and Graves we consider that "[t]here is no doubt that if students are to be effective in their ability to engage in the higher level thinking tasks associated with information literacy, they will need to regularly engage in these tasks and acquire strategies tailored to the diverse and ever-changing resources on the Internet" (1997, p .253). Web activities in cooperative learning environments are, we believe, a good step in this direction.

3. Writing activities in several curricular domains are a good way to improve writing skills, and provide students with an opportunity to approach language not only as an object of study in itself but as a learning tool in other curricular domains. In addition, the fact that texts were written for a real purpose and had a real audience also increases students interest in the task.

Videoconference and Web based activities are good pre-writing strategies not only because of students' gains in terms of language and curricular content we referred above, but also as a way to enhance the need for selection and organization of ideas, before writing. In fact, information gathered was usually so copious, rich and disperse, that they really fell the need to organize it.

In such a context, where content features were previously prepared, and peer interaction encouraged, word processor increases students interest in the writing task and stimulates constantly improvement of their text.

Experience clearly shows and research evidence suggests (Underwood, 1991) that the use of traditional writing tools makes it difficult to improve written texts, since it is necessary to repeat the writing process from start.

It is important that students do not force themselves to be correct at their first attempt. The process of transforming ideas in writing is hard owing to the various demands that operate simultaneously: the sequence of ideas, the vocabulary, the orthography, the syntax, the logical sequence of the text. We can think of few things at a time, so attention to all these aspects overloads short term memory and they tend to give priority to formal aspects rather than to more cognitive challenging requirements. Since word processor allows easy modifications in a drafted

text, students can pay attention to each aspect at a time: after expressing ideas, they debate until they arrive to the best form.

It seems that because it is so easy to correct, students are encouraged to make constant improvements in a first and free draft: they write, they modify as much as they need, often with colleagues' support, and the text remains clean.

It was observed that corrections students did within or after text production were dominated by spelling, punctuation, accentuation and vocabulary. It goes without saying that we are not surprised with their intervention at such a low level: it is the style of correction teachers usually uses! Obviously, we cannot expect students, spontaneously, do more. Technology by itself has had little impact on student achievement (Duffield, 1997).

But, if the teacher follows the writing process, going near the students that need assistance, he/she can understand the source of students' doubts and mistakes and, in consequence, he can support them in their attempts of correction. Focusing these real, specific and in context problems is a great way to practice grammar not as an end in itself but as a means of improving written communication. By doing so, and according to MacEnery, " [g]rammar learning means not studying and memorizing prescribed rules about grammar, but acquiring skills and insight into the ways in which grammar, that is to say the forms of words and the sequences in which they appear in sentences, paragraphs and texts, communicates meaning" (1997, p.9)

In addition to word processor performances, it seems that the motivation to discuss and make suggestions to improve early versions of the text was also enhanced by the cooperative nature of the task as well as the common use of the computer screen, the "virtual paper" (SablÉ and Bouyssou, 1995). As a consequence of group work in students tend to think aloud, expressing their own ideas and doubts, asking colleagues for what they do not understand. Each one made his contribution according to his own capacities, so text results from the combined effort of them all.

According to Dale (referred by Sanacore, 1997) "the real value of co-authoring groups is not the collaborative product but rather the peer interaction. As the students talk about their writings, they may discover novel ways of thinking about writing; however, this valuable growth may or may not be revealed in the written product". In fact, we are not sure that texts produced in word processor were much better than previous ones, but data collected demonstrated that, together, word processor in cooperative learning activities and teacher support, can really contribute to improve written skills. In addition, such an environment of speaking-reading-writing promotes a comprehensive development of all these skills.

4. Cooperative learning environments not only reinforce students' spontaneous disposition to share and discuss ideas but also encourage the less skilled ones to participate in task, in any way, and support their attempts. Naturally, there also occur some disagreements between students and this promotes rich and usually useful discussion. Through this dialog, they learn to explain and to specify their ideas and also how to understand colleagues' ideas and how to ask for more explanations. According to Bearison (referred by King) "resolving such cognitive conflicts should create some change in the learner's cognitive structures or processes. The aggregate of these changes in group member's cognition may promote the group's success in solving the problem" (1989, p.11).

Learning from one another, as it occurs in cooperative work, stimulates students engagement in their learning process thus increasing, as is pointed out by current constructivist learning theories, their responsibility in constructing their own knowledge. This is an important step in preparing students for the challenges of their tomorrow, since, more and more, one constantly needs to update knowledge and abilities in several domains (Leu, 1996).

Constructivist environments do not reduce teachers responsibilities in learning process, rather they require "a fundamental change in the way teachers approach instruction . . . [T]he highest compliment a teacher can receive from a learner is *you made this so easy that I was able to learn it by myself*" (Mehlinger, 1995, pp. 76-77).

5. There are no easy neither definitive answers to integrating technology into educational learning contexts. Yet, as Brownsuggests, "it takes about 30 years to blend a new idea into daily practice. In teaching new ideas and teaching methods cycle in and out favor more frequently. Integrating them solidly into practice, however, may still take several years" (1997, p. 17). Because we believe that for teachers good experiences are more motivating than good theories we consider that research must be rooted in concrete classroom activities.

The purpose of this study was to explore the contribution of educational technologies and cooperative work to develop linguistic and thinking skills. As the major authors of grounded theory suggest, research should be designed as a continually evolutionary process. We took a first step. Further data analysis will give a deeper

understanding of the problem bearing in mind that "in postmodern rëalm we cannot claim to know anything completely" (Addison, 1997, p. 107).

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